RIVER AND FLOOD SERVICE.

By PARK MORRILL, Forecast Official, in charge of River and Flood Service.

The month of May has brought the subsidence of the Mississippi flood. At points above the mouth of the Arkansas there was a steady fall in the river to stages as low or a little lower than usual at this season. The return of crevasse water to the river at lower points maintained high water longer. At Vicksburg the water fell slowly all the month, but was still 3 feet above danger line at its close. The crest of the flood did not reach New Orleans until the 8th, when the maximum stage of 19.6 feet was reached, and continued to the 11th. Later there was a slow fall to a stage of 18.2 feet at the end of May, which was 2 feet above danger line.

The highest and lowest water, mean stage, and monthly range at 119 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Cairo, Memphis, and Vicksburg, on the Mississippi; Cincinnati, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

The following résumé of river stages and conditions of navigation in the respective streams is compiled from reports by the officials of the Weather Bureau at various river stations and section centers:

Hudson River. (Reported by A. F. Sims, Albany, N. Y.)—The stage of water in the Hudson was normal up to the 7th, when a 7-foot freshet occurred.

Early on the morning of the 6th a serious break occurred in the Champlain Canal at the level below the two locks at Waterford; about 300 feet of the embankment was carried away, releasing the water let in on Monday and submerging adjacent fields. The Superintendent of Canals of the State of New York declared the canals open at noon of the 8th, and a half hour later boats were locked and hurried through. The Watervliet level presented an active scene; for several days the level was filled from Lock No. 3 to the Jones Car Company's works. The State basin was also jammed with the clumsy flotilla. There were 313 boats in the level, basin, slips, and river at the canal outlets in Watervliet.

The opening of navigation on the Champlain Canal was delayed until the 10th on account of leaks discovered 2 miles south of Fort Ann, necessitating the drawing of the water from the 12-mile level to make repairs. At noon of the 10th 350 of the fleet of westward moving canal boats had passed the weigh lock at Watervliet, or had taken out clearance papers. The breaks in the Champlain Canal necessarily delayed traffic on that branch, but a large number of boats took clearance papers for Whitehall in order to be ready. Most of the boats were empty and bound for Buffalo. It has seldom occurred that so many boats have passed the Watervliet weigh lock in so short a time.

At midnight of the 11th about 125 feet of the bank of the Champlain Canal gave way. The break was between Waterford and Mechanicsville; it was caused by quicksand.

The bad weather which prevailed during the first and second decades of the month has decreased the business of towing lines fully two-thirds below that of former years. Heretofore the ice companies have been engaged in forwarding many barges, but there has been very little demand for ice this year at New York, and in consequence little has been forwarded.

The rain of the 13th resulted in a 6-foot freshet in the Hudson, and caused market gardeners much anxiety. On the 15th the Hudson was 8 feet above mean low water. The color of the water flowing in the river at Albany pointed to heavy rainfall in the Schoharie Valley. On the 16th the river was very turbid, and dredging operations were suspended on account of high water; it became normal on the 18th.

The mountains in the eastern part of the Adirondack watershed were covered with snow on the morning of the 26th. Copious and frequent rains on the watershed in the eastern part of the State increased the volume of water flowing past Albany, and caused the Hoosic River to overflow its banks. All the tributary lakes and streams of the upper Hudson were very high during the third decade of the month.

Susquehanna River and branches. (Reported by E. R. Demain, Harrisburg, Pa.)—Heavy rains at the beginning of the month caused a general and in some streams a very decided rise in the waters, and these high stages were maintained by subsequent rains throughout the whole month. The average stage of the river at Harrisburg was nearly three times as great as during May, 1896, and it is believed the same could be said for the Susquehanna River system as a whole.

No floods of importance occurred except in the Juniata and its tributaries. The rain on the 1st and 2d of May caused a rise of 6.3 feet at Huntingdon between 8 a. m. of the 1st and 4:30 p. m. of the 2d, when the river reached a height of 10.1 feet. The rainfall was heaviest over the section drained by the Raystown branch of the Juniata, and considerable damage was sustained by farmers in the destruction of growing crops, fences, buildings, etc., by the flood of the 2d. The Juniata at Mifflin rose 7 feet between 8 a. m. of the 2d and 8 a. m. of the 3d, when it reached the maximum stage of the month, 12 feet. The greatest rise reported on the west branch of the Susquehanna occurred at Keating. On the 3d the river registered 7.7 feet, a rise of 7 feet in twenty-four hours.

In consequence of the breaks in the dam at Columbia, shad fishing has been carried on very successfully in the river at Harrisburg this season, and catches are reported as high up as the Juniata. Rapid progress has been made by the Pennsylvania Railroad Company on the new railroad bridge on the Susquehanna between Columbia and Wrightsville, and it was recently reported that the bridge will probably be so far advanced as to permit trains to pass over by June 7, 1897.

Rivers of South Atlantic States. (Reported by E. A. Evans, Richmond, Va.; C. F. von Herrmann, Raleigh, N. C.; L. N. Jesunofsky, Charleston, S. C.; D. Fisher, Augusta, Ga.; and J. B. Marbury, Atlanta, Ga.)—The James river was low during the entire month, there being only two rises, and those of an unimportant nature. At the beginning of the month the river was about the zero of the gauge but rising slowly, owing to moderate rains which had fallen over its basin. On the 4th and 5th 3.8 feet were recorded, after which the water receded slowly until the 14th, when it again rose to a maximum for the month of 7.4 feet, falling slowly thereafter until the close of the month. Neither of these rises caused any damage or apprehension, and no inconvenience beyond the muddying of the Richmond drinking water.

The stages of the rivers of North Carolina were generally low during the month. The precipitation throughout the month was moderate and the cultivated condition of the soil caused slow drainage to the streams and gradual rises. The heaviest rain occurred on the 1st, causing slightly higher stages from the 1st to the 4th, but not reaching within 20 feet of the danger lines on either the Cape Fear or the Roanoke. General rains from the 11th to the 16th caused another rise, culminating on the 16th, about equal to the first described. From that date the rivers slowly declined to the lowest stages at the end of the month. During the last decade of the month the floating of timber was interrupted, but navigation of the lower courses of the rivers was not interfered with.

No freshets occurred in the streams of South Carolina during May. The heavy rainfall over the eastern section of the State on the afternoon of April 30 and on May 1 did not raise the streams to any great extent. There was a 5-foot rise in the Wateree at Camden on the 4th, and a 6-foot rise in the Pedee at Cheraw on the 3d and 14th; other than these no decided rises were reported. Unusually low water was recorded during the last half of the month. The logging season was practically closed on all streams by the 10th. The Santee, the Wateree from St. Stephen to Camden, the Black, the Edisto, the Little Pedee, the Lynch, and the Congaree up to Granby Falls were navigable during the entire month. The Waccamaw was navigable from Winyah Bay to Conway from the 2d to the 28th. Navigation was suspended on the upper Pedee from a point 65 miles above Smiths Mills from the 22d to the 31st. Much freight is being held at Georgetown awaiting favorable steamboat water between Smiths Mills and Cheraw.

The changes in the Savannah River for the month are hardly worthy of comment; a moderately high stage prevailed during the first three days, caused by heavy but scattered showers falling in the up-river country and after this a steady fall was maintained, the entire range for the remaining 28 days being a little over 4 feet, while the 24-hour rise on the 2d was 8 feet. One of the regular line of boats was discontinued early in the month, leaving only two to accommodate river traffic, which at this season of the year reaches its minimum volume.

The month of May, 1897, was the driest during the past nineteen years in western Georgia, and, as a consequence, there was a general decline in the river stages throughout the month, and very low water prevails in Georgia rivers other than the Savannah.

Mobile River and branches. (Reported by F. P. Chaffee, Montgomery, Ala., and W. M. Dudley, Mobile, Ala.)—There was a gradual fall in the Alabama River and its tributaries during the entire month, except a slight recovery in the waters for a few days during the middle of the month, due to scattered rains; the Alabama is now so low as to stop traffic above Selma, except by boats of very light draught.

The Tombigbee River and its branches have also continued low throughout the month, there being but little general rain; the rain which fell was at long intervals, and, though heavy, covered such a short period of time that the rises caused thereby ceased as rapidly.

The rains of the 1st of the month caused slight rises at nearly all points to the 3d, when there was a general fall in all the streams to the 11th; the heavy rains of the 11th, 12th, and 13th caused much needed rises, and their effects were felt to the 18th, when the rivers began falling and so continued throughout the remainder of the month. Navigation was somewhat impeded up to the 10th, but the rains of the 11th to 13th, which caused the general rise, had the effect of giving good navigable stages to about the 25th.

Ohio River and branches. (Reported by F. Ridgway, Pittsburg, Pa.; H. L. Ball, Parkersburg, W. Va.; S. S. Bassler, Cincinnati, Ohio; F. Burke, Louisville, Ky.; and P. H. Smyth, Cairo, Ill.)—The upper Ohio and its tributary rivers have been open to packet navigation during the entire month, although water became very low during the last week; the lowest stage at Pittsburg for the month, 2.4 feet, was recorded on the 30th. Freight and passenger traffic on the principal packet lines was a little above the average for this season of the year. The coal operators enjoyed barge-water stages from the 3d to the 8th, and again from the 13th to the 18th; the water rose to a coal-boat stage on the 14th, 15th, and 16th, when 67,948 tons of coal passed through the lock at Davis Island en route for the southern markets.

General and moderately heavy rains occurred throughout West Virginia during the first five days of the month. The rivers, which had been falling slowly during the latter part of April, began rising on the 2d. Except in some of the small streams, the rise was light and without interest. A second period of general rains, from the 11th to the 14th, again caused a moderate rise in the rivers of the interior. The Ohio at Parkersburg rose slowly from the 2d to the 5th, reaching a maximum stage of 14.7 feet on the 5th. The second and greatest rise continued from the 12th to the 16th, with a maximum stage of 18.7 feet. From that date until the close of the month all the rivers fell slowly. Throughout the month all navigable streams maintained good boating stages, but business was reported as light and dull.

Nothing of importance occurred in connection with the river at Cincinnati during the month, except a sudden rise in the Licking on the 12th, and in the Kanawha on the 14th and 15th, which rises had considerable effect on the Ohio at this point. The highest stage (35 feet) was reached at Cincinnati on the morning of the 17th; after that date the river continued falling uninterruptedly, and was at the end of the month at a comparatively low stage, with every prospect of falling still lower. Navigation has been good and river traffic active, but fears are now entertained of too low water for up-river navigation.

At Louisville a good stage of water for navigation was maintained throughout the month, especially from the 6th to the 22d, during which time moderate rains kept the river slightly above the average height. During the remainder of the month a nearly normal stage prevailed.

The river at Evansville was rising from the 2d to the 9th, and from the 14th to the 20th; during the remainder of the month it was falling. During the last decade of the month the fall amounted to 15.8 feet, bringing the stage down to 10.6 feet, which is the lowest it has been at Evansville in three months.

At Paducah and Cairo the river fell during most of the month. The changes, however, were generally slight, except during the latter part of the month, when a marked fall set in. The stage at Cairo at the close of the month was 14.7 feet lower than at its beginning. Large tows of coal passed Cairo, going south, on the 2d, 12th, 14th, 17th, and 30th. Seep water continued over the ungraded portions of Cairo until about the 12th, and at the close of the month there were still some few low bottoms that were under water.

Tennessee and Cumberland rivers. (Reported by L. M. Pindell, Chattanooga, Tenn., and H. C. Bate, Nashville, Tenn.)—The Tennessee River was navigable during the entire month. A slight rise occurred during the first part of the month, which gave a splendid boating tide. A rainy spell set in on the 9th and 10th, lasting from three to five days at the various stations. The rainfall on the 12th and 13th was heavy, ranging from 1 to 2.97 inches. This caused the river to rise rapidly, reaching a stage of 22.4 feet on the 15th at Chattanooga, 17.1 feet on the 16th at Bridgeport, 13.6 feet on the 17th at Florence, and 20.6 feet on the 18th at Riverton. The stage recorded at Chattanooga on the 15th was the highest ever observed in May, except in 1893, when the river reached 30 feet. The river rose 10.6 feet in the twenty-four hours ending at 8 a. m. on the 14th. The heavy rains which occurred on the 12th and 13th caused the Sequatchie River, Emory River, and Bear Creek to rise and overflow the surrounding country, doing considerable damage to growing crops. The Clinch River at the headwaters also overflowed its banks. The Tennessee fell during the last half of the month. At Bridgeport navigation was practically closed on the 28th.

The month opened with a favorable stage of water at all points on the Cumberland River, and so continued until the last week of the month. Navigation above Carthage closed about the 26th, and above Nashville two or three days later. Boats continue to run to points on the lower river, but the steady fall now in progress promises to close navigation on the Cumberland by the 10th or 15th of June.

Mississippi River and minor branches. (Reported by P. F. Lyons, St. Paul, Minn.; M. J. Wright, Jr., La Crosse, Wis.; G. E. Hunt, Davenport, Iowa; F. Z. Gosewisch, Keokuk, Iowa; H. C. Frankenfield, St. Louis, Mo.; P. H. Smyth, Cairo, Ill; S. C. Emery, Memphis, Tenn.; R. J. Hyatt, Vicksburg, Miss.; R. E. Kerkam, New Orleans, La.; and C. Davis, Shreveport, La.)—There are no marked features in the condition of the upper Mississippi for May. A navigable stage of water existed up to St. Paul. There was a gradual and nearly steady fall of 0.3 foot per day at the latter point up to the 12th, when it diminished to about 0.1 foot, evidently because of the moderate rains about that time. Heavier rains brought the river to a stand from the 17th to 22d; then there was a steady fall again to the end of the month. Rafting has progressed with great activity in the vicinity of La Crosse. The Government engineers resumed work on this portion of the river during the latter part of the month.

The beginning of the month found the river well below the danger line at stations south to Muscatine, except La Crosse and Le Claire, and slightly below at those places. A slight rise occurred at most of the stations during the last four or five days of the month. The close of the month found the gauge readings from 3 to 7 feet below those at the end of April. The lack of rain in the upper Mississippi Valley explains the continued fall of the river. At only one station (Dubuque) did the monthly precipitation amount to more than half the normal.

At Keokuk the river fell steadily throughout the entire month. At the beginning of the month a large area of farming lands was overflowed, but by the 5th the river had fallen below the danger line, and by the 15th most of the flooded lands were dry enough for plowing. The month closed with a good stage of water for navigation, the channel on the Des Moines rapids being still navigable.

From Keokuk to St. Louis the river was still above the danger line at the beginning of the month, but was falling north of the Illinois River. From Grafton to St. Louis the crest was reached on the 2d, the extreme stage having been 23.2 feet at Grafton, and 31 feet at St. Louis. No damage was done further than that reported during April. The water went over the railroad tracks along the levee at St. Louis, but no serious inconvenience resulted. The fall commenced from Grafton southward on the 2d, and on the 5th the river at St. Louis was once more below the danger line. The fall continued throughout the month above the mouth of the Missouri, the water going below the danger lines at Keokuk and Hannibal on the 5th, and at Louisiana on the 10th. On the 3d the St. Louis, Keokuk and Northwestern Railroad resumed the use of its tracks from Quincy northward. The decline was particularly rapid at St. Louis, amounting to nearly 16 feet from the 2d to the 25th, when a slow rise commenced, due to local rains over the Missouri watershed within the State of Missouri. The rise continued until the 30th. The month closed with 16 feet of water on the gauge.

The Illinois River fell steadily throughout the entire month.

From St. Louis to Cairo the Mississippi was falling nearly the entire month. Immediately below Cairo slight rises were in progress from the 1st to the 4th and from the 16th to the 21st. The farm lands along the river between Cairo and Memphis, which a month ago were under water, have been plowed up and planted, mostly in corn. Many of the fields planted in corn during the month had on them, prior to the flood, fine wheat crops, which were drowned out and ruined by the high water.

On May 1 the river between Cairo and Memphis was generally within its banks; at the latter place it had fallen below the danger line, although the low banks on the Arkansas side were still covered with water and but little land was visible in that direction from the Memphis bluff until the 10th of the month. The decline at Helena was less rapid than at points above, owing to the continued high stage of the St. Francis, and the river at that place remained above the danger line until the 5th. After the 10th the decline became more decided, but was checked on the 20th, by water from the upper Mississippi, which caused a rise of nearly one foot at Memphis, and at Helena the river beame stationary on the 25th. From that time to the end of the month the daily fall was from 1 to 1.5 foot. The total decline in the river at Memphis was 15 feet, bringing the stage below that of the corresponding date in 1896. During the first decade of the month boats experienced some trouble in making landings, owing to the high water. Gauge readings were resumed on the Beal street gauge on the 30th instant, the water having become so low as to cut off the elevator gauge from the river.

Between Memphis and Vicksburg streams were high the 1st of May, but they fell steadily during the month to stages below the danger line at all points, except Vicksburg and Yazoo City. No unfavorable conditions occurred and a general improvement was noted all along the line. The overflowed districts were uncovered by the rapid decline in the rivers; the crevasses were closed and planting progressed as the water fell. The flood refugees returned to the plantations and stock was reshipped to the lowlands as fast as the water receded. The relief stations opened by the General and State governments were closed and conditions were more hopeful in all quarters for raising a crop. The railroads resumed operations west, but through travel was still interrupted north and south over Yazoo and Mississippi Valley Rail-

road, although repairs were being pushed with vigor. Mills and factories that had been idle for some time opened up again and new life and energy were imparted to all business in this section. The deposit left by the overflow has enriched the lands, and cotton planted on these lands since the overflow is doing well.

A slight decline set in below Vicksburg during the early days of the month, affecting Natchez but very slightly during the first ten days, after which a fall set in that continued to the close of the month. The river continued rising at Bayou Sara and Donaldsonville until the middle of the month, and remained nearly stationary at New Orleans until the 17th, after which there was a general decline. The fall was 4 feet at Natchez, 2.5 feet at Bayou Sara, 2 feet at Donaldsonville, and 1.5 foot at New Orleans by the close of the month.

On the 1st of the month the crevasse waters from above were approaching the Atchafalaya district; on the 2d the water was higher in Tensas Parish than in the flood of 1893. A break occurred in the levee at Angola plantation, opposite the mouth of Red River, in West Feliciana Parish at 11.30 a. m. of the 2d, and flooded about 6,000 acres of ground. By the 5th some planters were bringing back stock and preparing to replant lands in portions of Concordia Parish, the backwater falling slightly from Concordia northward. A small break occurred in the lower portion of Baton Rouge on the 8th, but was closed before any serious damage was done. On the 9th four breaks occurred in the ten-mile levee along Bayou des Glaises, aggregating a width of about 800 feet. On the 10th a small break occurred in the lower portion of Baton Rouge, followed by a second break on the 11th, which was closed, and a third on the 12th that was also closed. A "box" levee was built along the entire weak stretch that was completed by the 20th. On the 30th a break occurred at Conrad Point, about 8 miles by river below Baton Rouge and had widened to nearly 300 feet by the close of the month. This is the worst break that has occurred in that vicinity, but will probably be closed, since men and material in plenty have been shipped to that point.

There was a general decline in the Red River during the first half of the month, except in the upper portion, where heavy local rains caused a rise of about 16 feet at Arthur City on the 10th to 14th, followed by an 18-foot rise at Fulton, and a later rise in the lower river. The upper river declined after the middle of the month. There was sufficient water for navigation during the month. The gauge at Fulton was within 2 feet of the danger line (28 feet) on the 17th, but the lower stream was affected to a much less extent, Shreveport's maximum reading being only 15.1 feet.

The Ouachita declined steadily during the entire month, the lower river continuing at a navigable stage.

Missouri River and branches. (Reported by L. A. Welsh, Omaha, Nebr., and P. Connor, Kansas City, Mo.)—The Missouri River above Kansas City continued falling steadily during the first half of the month; from the middle to the close of the month the stage of water varied. A marked rise was noted during the last few days of the month and reports from the upper river were to the effect that the snow in the mountains was melting and that the "June rise" was on. These reports caused considerable uneasiness along the river, but proved to be unfounded. The rise was undoubtedly due to heavy rains, with possibly some snow water added. The condition of the extreme upper river, at the close of the month, was such that there was no fear of a return of high water. Reports received subsequent to the recent high stage of water substantiates the statement previously made that the damage caused by the spring flood was light. The east bank of the Missouri at Plattsmouth is cutting badly, and the Burlington and Missouri River Railroad Company is doing riprap work there, which is checking the cutting to some extent, but is not stopping it entirely.

The general tendency of the Missouri river at Kansas City was downward all the month. It was 0.7 foot below danger line on the 1st; on the 31st it was 6.8 feet below, with slight undulations in the meantime. The action of the swift current and falling river caused considerable cutting of the banks. About 6 miles east of this city the bank was cut away to the Kansas City and Independence Air Line Railroad and stopped the running of trains for several hours on the afternoon of the 2d, until the tracks could be moved back from the river. The Missouri, below Kansas City, fell until the 22d, when a slow rise commenced, due to local rains, which lasted about five days.

Arkansas River. (Reported by J. J. O'Donnell, Fort Smith, Ark., and F. H. Clarke, Little Rock, Ark.)—The upper Arkansas River fell steadily from the 1st to the 9th, then rose until the 13th, when the gauge at Fort Smith read 14.5 feet, and afterward fell until the end of the month, the average daily gauge reading being 10.1 feet. Navigation continued during the month.

A good boating stage prevailed in the lower Arkansas River throughout the month, there being no interruption to navigation from any cause. There were no floods, the river not even approaching the danger line at any station. The rise in the upper river at the end of April brought down light drift wood that collected in sufficient quantities against the false work of the bridge in course of construction across the river at Little Rock to carry away part of it and delay the work of construction several days. The rise in the lower river on the 2d and 3d was evidently from the Canadian River, the red color of the water being a sure index of the locality from which it came. At the close of the month a slight swell appeared in the upper river; the lower river continued declining, but still has fully 3 feet more water than is necessary for a good boating stage.

Rivers on the Pacific Coast. (Reported by W. H. Hammon, San Francisco, Cal.; J. A. Barwick, Sacramento, Cal.; and B. S. Pague, Portland, Oreg.)—No floods occurred during May on the Sacramento and San Joaquin rivers. Toward the close of the month the warm weather caused a rapid melting of mountain snow and the rivers increased in volume. On the afternoon of the 23d the levees broke at the Madera, Whitney, and Kerr ranches. On May 30 and 31, owing to high winds, the levees around Union Island in the San Joaquin River north of Tracy were endangered, and it was necessary in places to put in bulkheads to protect them, but with the subsidence of the wind the danger passed.

The Sacramento reached a point during the last few days of the month which caused the drainage of the overflowed tule basins in Yolo and Sutter counties through the numerous sloughs and breaks leading into the river and the cultivatable lands, as they are being drained, are put into a good state of tilth for planting crops which mature late. The prospect for a large acreage being planted is much better than for years past.

During the month the Columbia River rose to a height that usually obtains in the month of June, and caused the Willamette River to back up in the city of Portland, resulting in a stage of 23.7 feet on the 24th. At this height the lower docks are all covered and water enters the cellars on Front, First, and Second streets, and some of the deeper cellars on Third Street. At The Dalles the river rose to a height of 42.7 feet on the 24th, and at that city the docks were covered. The Columbia flooded most of the islands in the river and much of the lowland. Water of this height occurs almost every year, but usually during the month of June. On the overflowed land, which is principally used for hay and potatoes, excellent crops are grown after the water goes down. Potatoes planted on this land as late as the middle of July yield from 300 to 500 bushels to the acre.

Heights of rivers above zeros of gauges, May, 1897.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn.	1,957	14	10.0	1	5.3	30,31	7.0	4.7
Reeds Landing, Minn.	1,887	12	8.0	1	4.8	21	5.8	3.2
La Crosse, Wis.	1,822	10	9.8	1	6.3	18	7.7	3.5
North McGregor, Iowa	1,762	18	12.4	1	6.6	23-25	8.8	5.8
Dubuque, Iowa	1,702	15	13.2	1	6.4	25,26	9.1	6.8
Leclaire, Iowa	1,612	10	9.5	1	4.8	27	6.3	5.2
Davenport, Iowa	1,596	15	12.3	1	5.4	26-29	7.9	6.9
Keokuk, Iowa	1,466	14	16.2	1	5.5	30,31	9.5	10.7
Hannibal, Mo	1,405	17	19.6	1	6.8	31	11.6	12.8
Grafton, Ill	1,307	23	23.2	2	8.9	31	15.2	14.3
St. Louis, Mo.	1,264	30	31.0	2	15.2	25	21.7	15.8
Chester, Ill.†	1,189	30	26.1	3	11.6	25,26	17.3	14.5
Cairo, Ill	1,078	40	37.6	4	22.3	31	33.3	15.3
Memphis, Tenn	843	33	33.2	1	18.1	31	26.9	15.1
Helena, Ark	767	44	45.4	1	28.5	31	39.3	16.9
Arkansas City, Ark.	635	42	48.2	1	35.8	31	44.1	12.4
Greenville, Miss	595	40	42.5	1	31.2	31	38.7	11.3
Vicksburg, Miss	474	41	51.9	1	44.2	31	49.2	7.7
New Orleans, La	108	16	19.6	8,9,11	18.2	31	19.1	1.3
Arkansas River.								
Fort Smith, Ark.	345	22	17.3	1	5.6	28	10.1	11.7
Dardanelle, Ark.	250	21	16.5	2	4.7	29,30	9.7	11.8
Little Rock, Ark.	170	23	17.8	3	6.8	31	11.6	11.0
White River.								
Newport, Ark	150	21	17.1	1	4.1	29-31	8.9	13.0
Illinois River.								
Peoria, Ill.	135	14	11.5	1	6.9	31	9.2	4.6
Missouri River.								
Bismarck, N. Dak.	1,201	14	9.1	27,28	4.7	4,5	6.6	4.4
Pierre, S. Dak.	1,006	14	8.7	30	5.0	9	6.6	3.7
Sioux City, Iowa	676	19	12.1	31	8.4	12,13,15	9.8	3.7
Omaha, Nebr.	561	18	12.0	31	9.4	14,15	10.5	2.6
St. Joseph, Mo.	373	10	9.3	1	6.2	17	7.2	3.1
Kansas City, Mo.	280	21	20.3	1	12.8	18,19	14.6	7.5
Boonville, Mo.	191	20	19.6	1	10.6	21,22	13.0	9.0
Hermann, Mo.	95	21	15.8	1	6.8	21-23	9.5	9.0
Ohio River.								
Pittsburg, Pa	966	22	14.7	15	2.4	30	3.3	12.3
Davis Island Dam, Pa.	960	25	14.1	15	4.1	31	7.7	10.0
Wheeling, W. Va.	875	36	18.8	16	4.9	31	9.5	13.9
Marietta, Ohio	795	25	18.5	16	5.7	31	10.5	12.8
Parkersburg, W. Va.	785	35	18.7	16	6.4	31	11.2	12.3
Point Pleasant, W. Va.	703	36	28.0	15	5.4	31	13.9	22.6
Catlettsburg, Ky	651	50	33.7	15	7.5	31	18.2	26.2
Portsmouth, Ohio	612	50	34.0	16	9.2	31	19.7	24.8
Cincinnati, Ohio	499	45	35.0	17	12.0	31	23.1	23.0
Louisville, Ky.	367	24	12.2	18	6.3	30,31	9.2	6.0
Evansville, Ind	184	30	26.4	20	10.6	31	19.7	15.8
Mount Vernon, Ind.‡	148	35	25.5	20,21	11.0	31	20.7	14.5
Paducah, Ky.	47	40	27.9	21	11.8	31	22.6	16.1
Allegheny River.								
Warren, Pa	177	7	5.0	13	0.5	31	2.2	4.5
Oil City, Pa	128	13	5.7	14	1.7	31	3.1	4.0
Parkers Landing, Pa.	73	20	6.6	14	1.3	31	3.2	5.3
Freeport, Pa.	26	20	11.0	14	2.8	31	5.9	8.2
Conemaugh River.								
Johnstown, Pa.	64	7	6.3	2	1.2	31	2.3	5.1

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Red Bank Creek.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Brookville, Pa.	35	8	0.4	4	—0.9	29-31	—0.5	1.3
Beaver River.								
Ellwood Junction, Pa.	10	14	3.3	2	0.4	31	1.5	2.9
Big Sandy River.								
Louisa, Ky.	26	20	20.1	15	4.4	31	8.2	15.7
Cumberland River.								
Burnside, Ky	434	50	37.4	14	1.8	31	9.2	35.6
Carthage, Tenn.	257	30	26.3	16	2.8	31	10.2	23.5
Nashville, Tenn	175	40	38.2	18	4.4	31	13.6	23.8
Great Kanawha River.								
Charleston, W. Va.	61	30	21.0	14	4.7	25,26	7.2	16.3
New River.								
Radford, Va.	153	14	2.0	14	0.5	29,30	0.9	1.5
Hinton, W. Va.	95	14	9.8	14	1.9	30,31	3.2	7.9
Licking River.								
Falmouth, Ky.	30	25	16.4	12	1.7	31	5.6	14.7
Miami River.								
Dayton, Ohio	69	18	4.6	3	2.0	31	2.9	2.6
Monongahela River.								
Weston, W. Va.	161	18	.....	.....	.....	.....	.....	.....
Fairmont, W. Va	119	25	15.1	14	0.6	31	3.1	14.5
Morgantown, W. Va.	95	20	18.2	14	7.2	30,31	9.1	11.0
Greensboro, Pa.	81	18	17.0	14	7.6	1,25-31	9.4	9.4
Lock No. 4, Pa.	40	28	20.6	15	6.6	31	9.8	14.0
Cheat River.								
Rowlesburg, W. Va.	36	14	7.0	3,14	2.0	1,10,11	4.3	5.0
Youghiogheny River.								
Confluence, Pa.	59	10	5.5	2	1.0	31	2.8	4.5
West Newton, Pa.	15	23	6.4	3	0.9	30,31	2.5	5.5
Tennessee River.								
Knoxville, Tenn.	614	29	.....	.....	.....	.....	.....	.....
Rockwood, Tenn	519	20	.....	.....	.....	.....	.....	.....
Chattanooga, Tenn.	430	33	22.4	15	4.1	30	8.3	18.3
Bridgeport, Ala	390	24	17.1	16	2.5	31	6.4	14.6
Florence, Ala.	220	16	13.6	17,18	2.7	30,31	6.3	10.9
Johnsonville, Tenn.	94	21	19.5	19,20	4.8	31	10.1	14.7
Wabash River.								
Terre Haute, Ind.	165	16	9.2	14	2.8	31	5.5	6.4
Mt. Carmel, Ill.	50	15	10.4	16	5.0	31	7.7	5.4
Red River								
Arthur City, Tex.	668	27	21.9	14	5.2	10	11.8	16.7
Fulton, Ark	565	28	26.0	17	6.8	11	14.9	19.2
Shreveport, La.	449	29	15.1	25-27	8.1	14	12.2	7.0
Alexandria, La.	139	33	30.5	1	15.7	17	17.6	4.8
Atchafalaya River.								
Melville, La.	100*	31	36.1	15	35.2	30,31	35.8	0.9
Ouachita River.								
Camden, Ark.	340	39	8.4	1	4.3	29-31	6.0	4.1
Monroe, La.	100	40	35.5	1	28.4	31	31.8	7.1
Yazoo River.								
Yazoo City, Miss.	80	25	31.5	1,2	27.6	31	30.0	3.9
Tombigbee River.								
Columbus, Miss.	285	33	6.8	16	—1.6	31	2.3	8.4
Demopolis, Ala.	155	35	19.2	17	1.5	31	9.0	17.7
Black Warrior River.								
Cordova, Ala	155	20	7.1	13	2.0	31	3.5	5.1
Tuscaloosa, Ala.	90	38	20.5	15	2.0	31	6.9	18.5
Alabama River.								
Montgomery, Ala.	265	35	8.3	2	1.8	31	4.0	6.5
Selma, Ala.	212	35	11.0	3	2.6	31	6.1	8.4

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Coosa River.	*Miles*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Rome, Ga.	225	30	5.0	15	1.9	30,31	2.9	3.1
Wilsonville, Ala.	66	15	3.9	17	2.7	30,31	3.3	1.2
Tallapoosa River.								
Sturdevant, Ala.	69	15	2.3	1	0.7	31	1.4	1.6
Savannah River.								
Augusta, Ga.	130	32	16.9	2	6.8	28,29,31	8.7	10.1
Edisto River.								
Edisto, S. C.	75	6	4.2	8	1.5	31	3.1	2.7
Congaree River.								
Columbia, S. C.	37	15	3.4	4	1.3	7,8	1.7	2.1
Santee River.								
St. Stephens, S. C.	50	12	7.3	10	3.5	31	6.2	3.8
Wateree River.								
Camden, S. C.	45	24	11.8	15	4.8	29	7.2	7.0
Black River.								
Kingstree, S. C.	60	12	7.9	17	4.7	31	6.9	3.2
Pedee River.								
Cheraw, S. C.	145	27	14.9	3	2.4	31	5.3	12.5
Lynch Creek.								
Effingham, S. C.	35	12	9.3	9,10	3.5	27,28	5.8	5.8
Lumber River.								
Fair Bluff, N. C.	10	6	4.5	8	1.0	31	3.2	3.5
Waccamaw River.								
Conway, S. C.	40	7	4.0	18	2.2	31	3.3	1.8
Cape Fear River.								
Fayetteville, N. C.	100	38	17.4	15	4.0	29	7.0	13.4
James River.								
Lynchburg, Va.	257	18	10.4	14	0.9	31	2.7	9.5
Richmond, Va.	110	12	7.4	16	0.1	1,31	1.6	7.3
Potomac River.								
Harpers Ferry, W. Va.	170	16	11.7	15	1.5	1	5.4	10.2
Susquehanna River.								
Wilkesbarre, Pa.	178	14	.....	.....	.....	.....	.....	.....
Harrisburg, Pa.	70	17	7.9	16	3.1	1,2	5.0	4.8
W. Br. of Susquehanna.								
Lock Haven, Pa.	63	10	4.5	4	1.0	30,31	2.2	3.5
Williamsport, Pa.	35	20	8.8	4	2.0	31	4.9	6.8
Juniata River.								
Huntingdon, Pa.	80	24	7.2	3	3.5	30,31	4.4	3.7
Sacramento River.								
Redbluff, Cal.	241	23	6.9	3	3.7	28-31	4.8	3.2
Sacramento, Cal.	70	28	22.5	7	19.6	30,31	21.3	2.9
Willamette River.								
Eugene, Oreg.	149	10	5.2	14,15	3.2	29	4.3	2.0
Albany, Oreg.	99	20	6.0	7,14-16	3.8	29	5.1	2.2
Salem, Oreg.	69	20	6.2	14,15	3.7	31	5.3	2.5
Portland, Oreg.	10	15	23.7	24,25	15.8	5	20.1	7.9

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Eugene, Oreg.	149	10	8.0	10,17,18	4.4	30	6.4	3.6
Albany, Oreg.	99	20	11.2	8	6.0	30	9.0	5.2
Salem, Oreg.	69	20	11.6	20	6.4	30	9.5	5.2

* Distance to the Gulf of Mexico.
† Record for 30 days.
‡ Record for 24 days.

SPECIAL CONTRIBUTIONS.

RECENT PUBLICATIONS.

By HERMAN W. SMITH, Librarian, Weather Bureau.

Austria.—Hartl, Heinrich. Meteorologische und Magnetische Beobachtungen in Griechenland. Wien, 1897. 8vo. 32 pp. 1 chart.
Pernter, J. M. Die Farben der Regenbogen und der weisse Regenbogen. Wien, 1897. 8vo. 101 pp. 3 pls.

British Empire.

England.—Baxendell, Joseph. An account of an Investigation, as to Short-period Cyclical Changes in the Magnetic Conditions of the Earth, and in the Distribution of Temperature on its Surface. Liverpool, 1897. 8vo. 7 pp.
Baxendell, Joseph.—The Fernley Observatory. Report and Results of Observations, for the year 1896. Southport, 1897. 8vo. 30 pp.

France.—Commission Météorologique du Département de Vaucluse. Compte-Rendu pour l'Année 1896. Avignon, 1896. 4to. 31 pp.

Germany.—Klein, Hermann J. Jahrbuch der Astronomie und Geophysik. VII Jahrgang 1896. Leipzig, 1897. 8vo. x, 400 pp.
Marcuse, Adolf.—Die atmosphaerische Luft. Eine allgemeine Darstellung ihres Wesens, ihrer Eigenschaften und ihrer Bedeutung. Berlin, 1896. 8vo. 76 pp.
Schneider, Phil. Emil.—Enstehung und Prognose der Wirbelstürme. Regensburg, 1895. 8vo. 112 pp. 24 pls.

Netherlands.—Observations made at the Magnetic and Meteorological Observatory at Batavia. Vol. XVIII. 1895. Batavia. Folio 256 pp.
Regenwaarnemingen in Nederlandsch-Indie. Jaargang 1895. Batavia. 8vo. x, 423 pp.

Sweden.—Hildebrandsson, H. Hildebrand.—Quelques recherches sur les centres d'Action de l'Atmosphère. Stockholm, 1897. 4to. 36 pp. 7 pls.

United States of America.

Connecticut.—Ninth Annual Report of the Storrs Agricultural Experiment Station. Middletown, 1897. 8vo. 292 pp.
Twentieth Annual Report of the Connecticut Agricultural Experiment Station. New Haven, 1897. 8vo. 414 pp.

District of Columbia.—Langley, S. P.—Memoir of George Brown Goode, 1851-1896. Washington, 1897. 8vo. 30 pp.

Illinois.—Crehore, Albert Cushing and Squier, George Owen. The Synchronograph. A new method of rapidly transmitting intelligence by the alternating current. Chicago, 1897. 8vo. 31 pp. 5 pls.

Massachusetts.—Means, James. The Aeronautical Annual for 1897. Boston, 1897. 8vo. 176 pp. 18 pls. and 1 diagram.

North Dakota.—Fourth Annual Report of the North Dakota Weather Service. Fargo, 1897. 8vo. 78 pp.